Name________________________________ **Lab Section**__________ **Date**______________

INTRODUCTION:

In this laboratory the student will investigate both the Thevenin and Norton Equivalent Circuits along with the Maximum Power Transfer Theorem.

PRELAB:

1. Determine the Thevenin and Norton equivalent circuit parameters for the circuit shown in Figure 7.1:

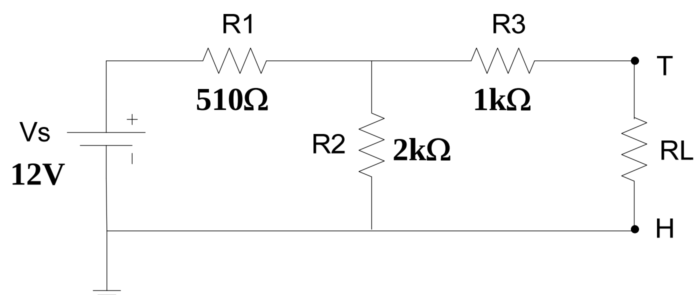


Figure 7.1: Series-Parallel Circuit.

2. Record the calculated parameters in the spaces provided below and record them in Table 7.2.

$V_{TH(Calculated)}$ = ____________ $R_{TH(Calculated)}$ = ____________ $I_{N(Calculated)}$ = ____________

3. Sketch both the Thevenin and Norton equivalent circuits in the spaces provided below and label the values of the circuit elements.

4. If a load resistance of 470 Ω is connected to terminals T and H, calculate the theoretical load voltage, current, and power using your Thevenin's Equivalent and record the results below and in Table 7.3.

$V_{RL(Calculated)}$ = ____________ $P_{RL(Calculated)}$ = ____________

5. Determine the value of the load resistance R_{LmaxP} that would result in maximum power to be transferred from the circuit to the load resistor and calculate the maximum power value P_{RLmax}.

$R_{LmaxP(Calculated)}$ = ____________ $P_{RLmax(Calculated)}$ = ____________

PROCEDURE:

1. Measure the values of the circuit resistors and record the results in Table 7.1.

2. Construct the circuit shown in Figure 7.1, but with terminals "T" and "H" open-circuited.

3. With the power supply turned off, connect a jumper wire between the supply's positive binding post and the supply's negative binding post. Doing so will short-circuit at the supply V_s.

4. Use a multimeter to measure the Thevenin resistance seen "looking into" terminals T and H and record the value in Table 7.2.

5. Remove the jumper wire between the supply's positive binding post and the supply's negative binding post. Then, turn on the supply and set its voltage to 12.0V.

6. Use the multimeter to measure the Thevenin voltage across terminals T and H (without the load resistor present). Record the result in Table 7.2.

7. Use the multimeter to measure the (short circuit) Norton current from terminals T to H and record the measured current in Table 7.2. To perform this the measurement, you can simply connect the multimeter test leads to the supply terminals with the meter configured to measure current since the meter has almost zero internal resistance in this configuration.

8. Place the 470Ω load resistor between terminals T and H and measure the load voltage. Record the value in Table 7.3.

9. Remove the load resistor, replace it with a decade resistor box, and set the load resistance to 800Ω

10. Measure the load voltage and current and record the values in Table 7.4.

11. Calculate the power delivered to the load and record the value in Table 7.4.

12. Repeat steps 10 and 11 for load resistances ranging from 1000Ω to 2400Ω in 200Ω increments and record the results in Table 7.4.

13. Using the measured Thevenin voltage and resistance values, construct a Thevenin equivalent circuit with a second decade resistance box for the Thevenin resistance.

14. Repeat steps 10 and 11 for load resistance values ranging from 800Ω to 2400Ω in 200Ω increments and record the results in table 7.5.

DATA: **Name: ________________________________**

Table 7.1: Measured Resistor Values

Resistance	**R_1**=510Ω	**R_2**=2kΩ	**R_3**=1kΩ	**R_L**=470Ω
Measured				

Table 7.2: Measured & Calculated Thevenin's and Norton's Equivalent Parameters

	R_{TH}	V_{TH} (V)	I_N (mA)
Prelab Calculated			
Measured			

Table 7.3: Measured Voltage and Current of Circuit 7.1 under Load

R_L=470 Ω	V_{RL} (V)	P_{RL} (mW)
Prelab Calculated		
Measured		

Table 7.4: Load Voltages, Currents, and Calculated Powers from the Original Circuit

R_L (Ω)	$V_{RL(Measured)}$ (V)	$I_{RL(Measured)}$ (mA)	$P_{RL(Calculated)}$ (mW)
800			
1000			
1200			
1400			
1600			
1800			
2000			
2200			
2400			

Table 7.5: Load Voltages, Currents, and Calculated Powers from the Thevenin Equivalent Circuit

R_L (Ω)	$V_{RL(Measured)}$ (V)	$I_{RL(Measured)}$ (mA)	$P_{RL(Calculated)}$ (mW)
800			
1000			
1200			
1400			
1600			
1800			
2000			
2200			
2400			

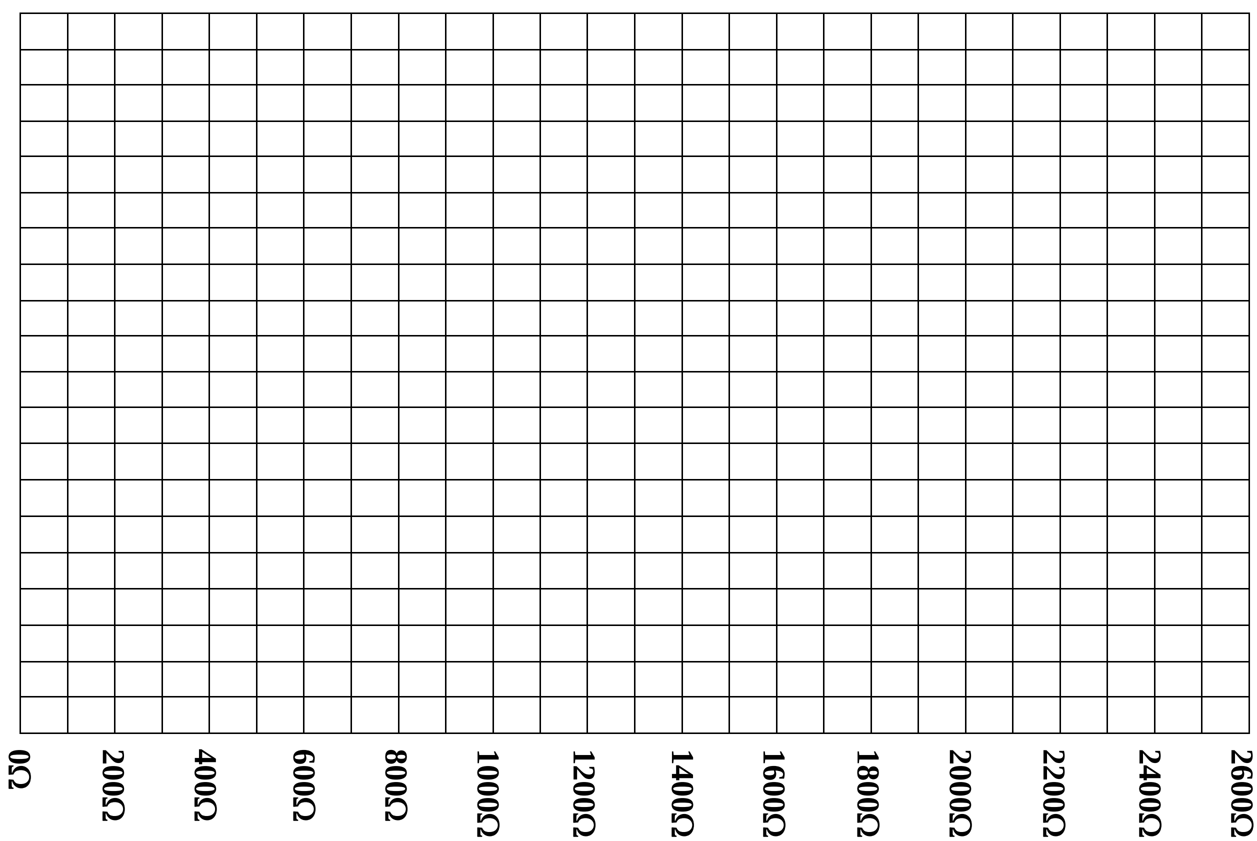
ANALYSIS: **Name: ________________________________**

1. Plot Load Power as a function of Load Resistance for the original circuit (Table 7.4) on the graph provided below.

2. On the same graph, plot Load Power as a function of Load Resistance for the Thevenin Equivalent Circuit (Table 7.5).

3. Graphically determine the load resistance that results in the maximum power transferred to the load and the maximum power value for both the original circuit and the equivalent circuit.

4. Compare the Load Resistance and Maximum Power values determined from the plot to the values calculated for the PreLab and discuss whether or not the results confirm the Maximum Power Transfer theorem.



Approved by: ________________________________ **Date: ________________**